9.0 INFORMATION PRESENTATION

9.1 TEXT INFORMATION

9.1.1 Text Font, Size, and Style

Text is presented using the default font, size, and style defined by Motif (i.e., CDE) or Windows (see section 7.1.6.2 and appendix D).

Motif: CDE distinguishes between system and user fonts, using a proportional-width font for the former and a fixed-width font for the latter. The system font is used for system areas such as menu bars, push buttons, toggle buttons, and labels, while the user font is used for text entered into windows. The Font control in Style Manager provides users with a choice of seven font sizes in which to display the system and user fonts.

Windows: Text in title bars and menus is presented in a 10-point sans serif bold font. Text in dialog windows and icon labels uses an 8-point sans serif bold font, while text in status bars is a 10-point sans serif, non-bold font.

When a choice of fonts is available to the application, a sans serif bold font is used so that text is readable when presented normally or grayed out, even if screen resolution is degraded.[1] The font is of sufficient thickness and size to be readable when users are seated at a normal viewing distance from the screen. The DoD style guide indicates that at a minimum, character height should be 1/200 of viewing distance (e.g., a viewing distance of 36 inches requires a .18 inch character height on the screen).

9.1.2 Capitalization, Grammar, and Punctuation

Text (including titles and major headings) is presented in mixed case, following standard capitalization rules. All upper-case letters are used in text only for acronyms and abbreviations and for emphasis. Arabic rather than Roman numerals are used when information has to be numbered.

Continuous text (e.g., directions, messages to users) is phrased in simple sentences, in the affirmative (rather than negative) and in active (rather than passive) voice, as shown in figure 9-1. A sequence of events or steps is presented in the order they are performed. The referent for “it” or “they” in a sentence is easily identified. Normal punctuation rules are followed, and contractions and hyphenation are avoided. Paragraphs are kept short and separated by at least one blank line.

Do this:	Not this:
Press ENTER to continue.	The user should press ENTER to continue.
Clear screen before entering data.	Do not enter data before clearing the screen.
Select one.	Will you make a selection?

Figure 9-1. Example of wording style.

[1] Kobara recommends the use of sans serif, variable pitch fonts (e.g., Helvetica) for labels and system messages and serif, fixed pitch fonts (e.g., Courier) for text entry areas.

9.1.3 Acronyms and Abbreviations

Acronyms and abbreviations are used only when they are significantly shorter than the full word and are commonly understood by users (e.g., are related to normal language or are specific job-related terminology). Abbreviations are the shortest possible that will ensure uniqueness. Abbreviations are used consistently within the application. Words not commonly abbreviated are not abbreviated. The DoD style guide recommends that acronyms and abbreviations comply with the following documents:

AR 310-50. Authorized Abbreviations and Brevity Codes

MIL-STD-12D. Abbreviations for Use on Drawings, Specifications, Standards, and in Technical Documents

MIL-STD-411E. Aircrew Station Alerting Systems

MIL-STD-783D. Legends for Use in Aircrew Stations and on Airborne Equipment

New acronyms are generated according to rules contained in MIL-STD-12D. When abbreviations or acronyms are used, a dictionary is available to users (e.g., as an option in the Help menu).

9.1.4 Formats for Date/Time and Latitude/Longitude[2]

The application uses the following format when presenting date/time information:

The date is displayed as YYMMDD, where YY is the last two digits of the year, MM is the month, and DD is the day, or as DD MMM YY, where DD is the day, MMM is the month, and YY is the last two digits of the year.

Time is displayed as HHMM[SS]Z, where HH is the hour of a 24-hour day, MM is the minute, SS (optional) is the second, and Z is the time zone (Zulu [Z] time is the default).

Date/Time Group (DTG) is displayed as DDHHMMZ MMM YY, where DD is the day, HH is the hour, MM is the minute, Z is the time zone (Zulu is the default), MMM is the month, and YY is the year.

The application displays latitude and longitude in separate fields, with the labels “Lat” and “Long.” Latitude is displayed in one of the following formats:

D{D}H, where D (one or two characters) is the degrees of latitude and H is the hemisphere (N for North, S for South).

DD{MM{SS}}H, where DD is the degrees of latitude, MM is the minutes of latitude (optional), SS is the seconds of latitude (optional, but can only be given if minutes of latitude is given), and H is the hemisphere (N for North, S for South).

Longitude is displayed in one of the following formats:

D{D{D}}H, where D (one, two, or three characters) is the degrees of longitude and H is the hemisphere (E for East, W for West).

[2] The DoD style guide recommends these formats when presenting date/time and latitude/longitude information.

DDD{MM{SS}}H, where DDD is the degrees of longitude, MM is the minutes of longitude (optional), SS is the seconds of longitude (optional, but can only be given if minutes of longitude is given), and H is the hemisphere (E for East, W for West).

9.1.5 Wild Card Characters in Text Searches

Users can enter wild card characters to search for specific text patterns if this capability is appropriate to the functionality of the application.[3] The following wild card conventions are used if this search capability is available:

@ searches for the occurrence of a single upper- or lower-case alphabetic character. For example, abc@d retrieves the strings abcad, abced, and abczd; abc7d and abcddd do not match the search pattern and are not retrieved.

searches for the occurrence of a single numeric character. For example, 123#4 retrieves the strings 12334, 12394, and 12304; 123x4 and 123554 do not match the search string and are not retrieved.

? searches for the occurrence of a single alphanumeric character (a - z, A - Z, 0 - 9, and punctuation marks). For example, abc?d retrieves the strings abcad, abcAd, abc(d, and abc9d; abcxxd does not match the search string and is not retrieved.

* searches for the occurrence of zero or more alphanumeric characters. For example, abc*d retrieves the strings abcad, abcd, abfklsmd, and abc7d; abcd5 does not match the search string and is not retrieved.

9.1.6 Presenting Tabular Information

When information is presented in tabular form, each column of information has a heading, and the information in one column is clearly separated from that in other columns (usually by at least four character spaces). Data groupings are indicated with blank space, separator lines, and/or different intensity levels; multiple colors are used only if they provide additional meaning.

Alphabetic information is left-justified within a column, numeric information without decimals is right-justified, and numeric information with decimals is justified by the decimal point, as shown in figure 9-2. Long strings of numbers are delimited with spaces or commas to facilitate readability, and leading zeros are not used unless required for clarity. If the information extends beyond a single line, additional lines are indented to indicate they are continuations.

[3] The wild card characters included here are taken from the DoD style guide which recommends their use if appropriate to the application.

Do this:	Not this:
Artillery Tanks Jeeps Aircraft	Artillery Tanks Jeeps Aircraft
400 4210 38 3911	400 4210 38 3911
1.5 10.38 1.365 500.0	1.5 10.38 1.365 500.0

Figure 9-2. Example of data justification within columns.

Tabular information is grouped or arranged so that users can identify similarities, differences, trends, or relationships. For example, depending on the purpose of the window, the information can be presented in sequential, spatial, alphabetical, functional, or chronological order. Information that is particularly important, requires immediate user response, and/or is used more frequently is presented first in the table.

9.2 GRAPHICAL INFORMATION

9.2.1 Line Graphs and Surface Charts

Line graphs, such as those shown in figure 9-3, are used to present trend information, spatially structured information, time critical information, or relatively imprecise information. The axes of the graph are clearly labeled and include the unit of measurement as appropriate. The labels are in mixed case and oriented left to right (including the vertical axis of a graph) for normal reading. The minimum and maximum value are indicated on each axis, with up to nine intermediate markings showing gradations on the axis. The starting point on each axis is zero, with the gradations indicated in whole numbers, unless a zero starting point is inappropriate for the data being displayed. The gradations are at standard intervals (e.g., 1, 2, 5, 10), with intervening gradations consistent with the labeled scale interval.

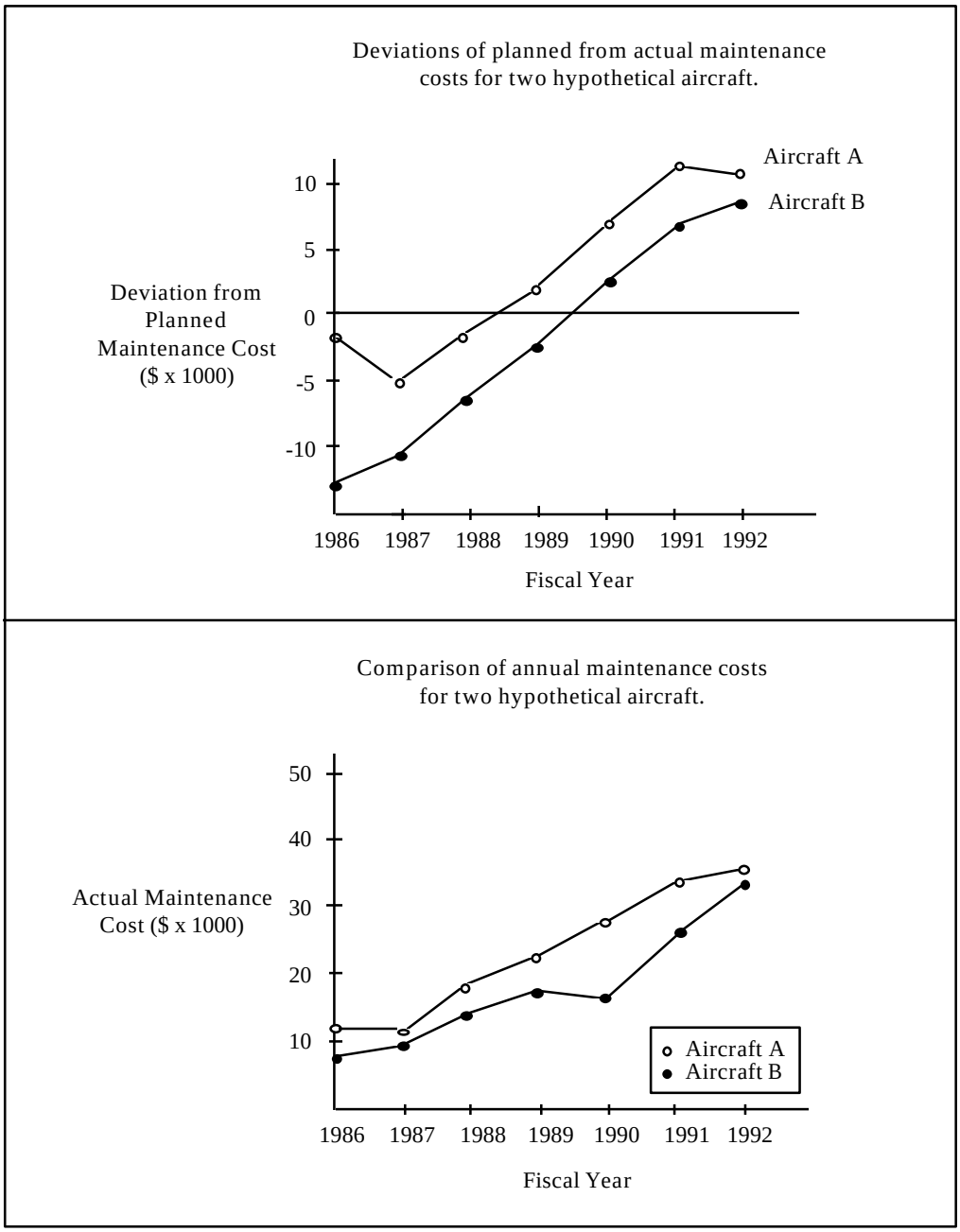

Figure 9-3. Example line graphs.

Labels are used instead of legends or keys when it is necessary to identify the data that are plotted on the graph. The labels are oriented horizontally and located next to the data being referenced. Each line or curve on a graph is labeled and coded (e.g., with solid, dashed, dotted lines), and a line or curve containing critical or abnormal data is coded (e.g., by color, line thickness, annotation) to call attention to that part of the display. If grid lines are included in a graph, they are unobtrusive and do not obscure the data presented in the graph; users can display or suppress grid lines as desired.

A line graph is limited no more than five lines/curves, with each one identified by an adjacent label (rather than in a separate legend). If corresponding data are presented in multiple graphs, the same

coding scheme is used in each graph. Coding is also used to highlight more important or critical information or to identify actual from projected data within the graph.

If users are required to compare multiple trend lines, the lines are presented on a single graph. If the lines have to be presented in multiple graphs, users can redraw the graphs using the same scale on both graphs to facilitate comparison. If users have to read precise values from a graph, options are available to display the actual data values on the graph and to zoom the display if necessary. In addition, aids are provided for scale interpretation (e.g., displaying a grid upon request, providing vertical and horizontal rules that the user can move to the intersection point, or letting users click on a point on the graph and having the exact values displayed in a pop-up window).

A surface chart is a type of line graph in which the data being depicted represent all parts of a whole. The curves/lines are stacked above one another to indicate aggregated amounts, and the area between each curve/line is coded using different colors, shadings, or textures and identified by a text label displayed within the area. If a surface chart is used, the data categories are ordered to reflect the logical organization of the entity being displayed. If no a priori organization exists, the data categories are ordered so that the least variable ones are at the bottom and the most variable at the top.

9.2.2 Bar Charts and Histograms

A bar chart, such as the ones shown in figure 9-4, is used to compare a single measure at several intervals, and a histogram to compare a single measure when the number of intervals is large. The bars in a related set of bar charts have a consistent orientation (vertical or horizontal), and bars containing data that must be compared are presented adjacent to one another. Frequency counts are usually displayed in vertical bars, and time durations in horizontal bars. If the displayed data have to be compared with a critical value, a reference index is provided.

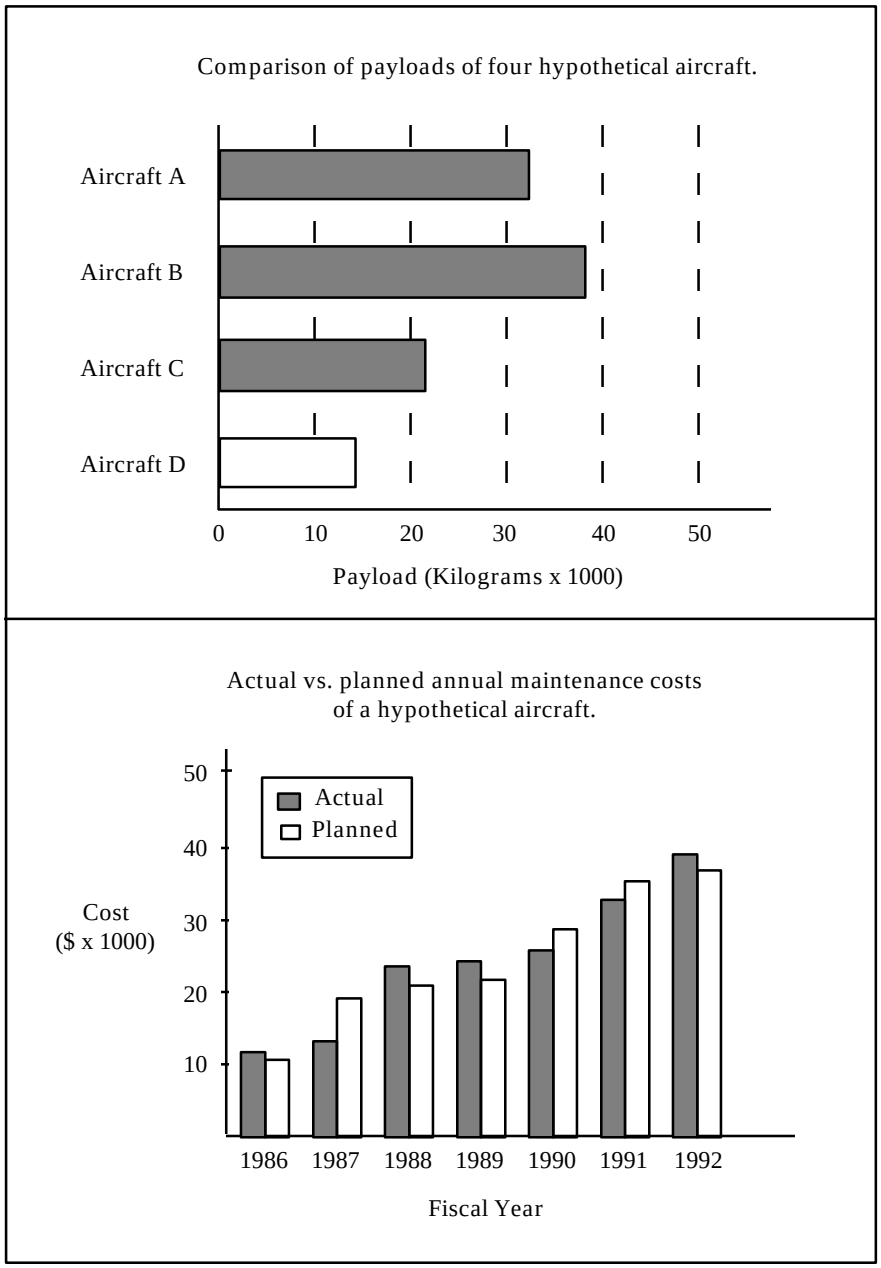

Figure 9-4. Example bar charts.

If the number of bars being displayed is small, a bar chart is used, with the bars separated, using one-half or less of the bar width as the spacing between bars. If the number of bars is large, a histogram is used (i.e., eliminating the spacing between the bars). Coding (e.g., color, shading, texture) is used to distinguish among different groups of bars or to highlight important data in one or more of the bars. If multiple bar charts or histograms are presented, related groups of bars are presented in a consistent order in each one. Each bar is identified with its own text label, rather than presenting the labels in a separate legend.

The bar chart or histogram is designed to conform to user expectations. Charts and axes are clearly labeled, and important information is highlighted. When bars are presented in pairs, they are labeled as a unit, with a legend provided that distinguishes between the bars.

Stacked bars are used when both the total measures and the portions represented by segments are of interest. This arrangement of bars is similar to a surface chart. If stacked bars are used, the data categories are presented in the same sequence. As with surface charts, data categories are ordered so that the least variable are at the bottom of the bar and the most variable are at the top. The areas within each bar are coded using different colors, shading, or texture and identified by a text label displayed within the area.

9.2.3 Flow Charts

A flow chart is used to present a schematic representation of sequences or processes. The path indicated in the flow chart is left to right, top to bottom, or clockwise. Each decision point in the flow chart contains a single, simple decision, as shown in figure 9-5. The elements and lines are coded (e.g., symbol and shape coding) to assist in understanding, and the same coding scheme is used throughout the flow chart. For example, the flow chart provides directional indicators (arrows) to indicate the sequence to be followed. A legend is included that describes each element and code used in the flow chart, and critical information and/or steps are highlighted.

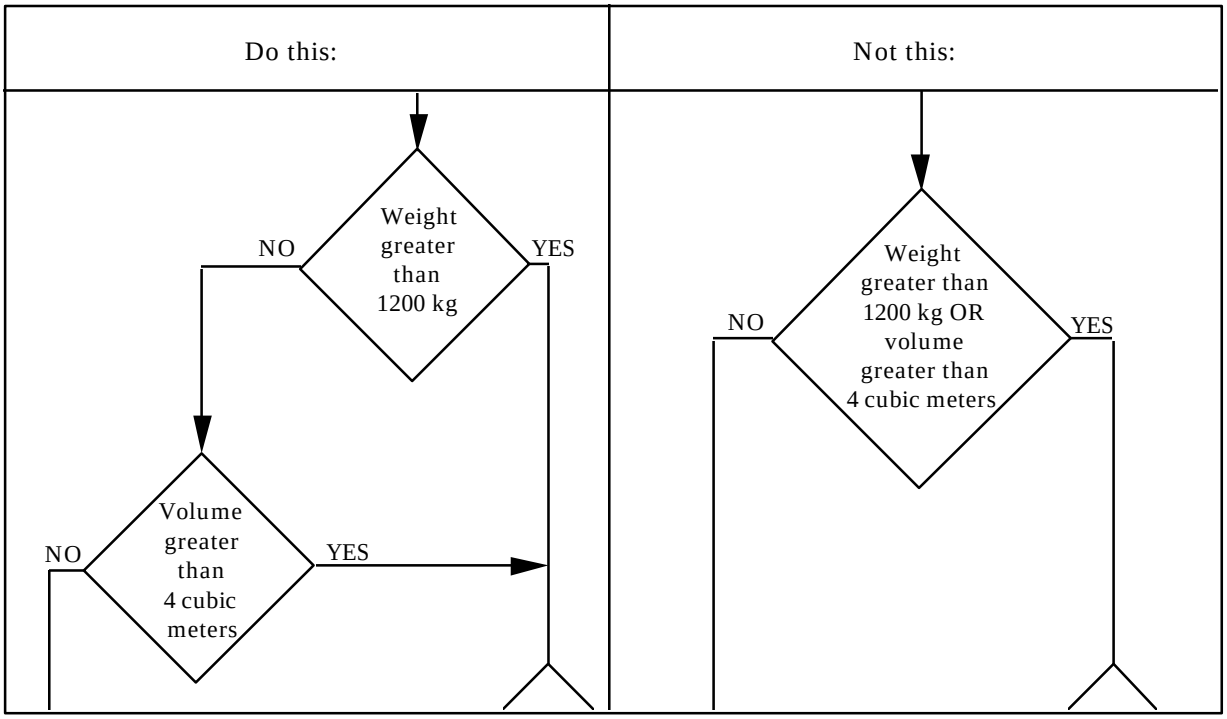

Figure 9-5. Example of labeling decision points in a flow chart.

The steps presented in a flow chart are ordered logically (i.e., follow the sequence of operations, steps, or processes from start to finish), or the most important decisions or the decisions that can be made with the greatest certainty are placed first. If no ordering scheme can be identified, the flow chart is organized to minimize the length of the path through it.

The shapes (e.g., boxes) used in the flow chart follow existing shape coding conventions, and the text presented in the chart is oriented for normal reading. Important elements (e.g., paths through the chart) are emphasized through coding such as color.

9.2.4 Pie Charts

A pie chart (shown in figure 9-6) is used to provide an approximation of how an entity is apportioned into component parts. If an accurate estimate of proportions or quantitative information is needed, a bar chart is used instead of a pie chart.

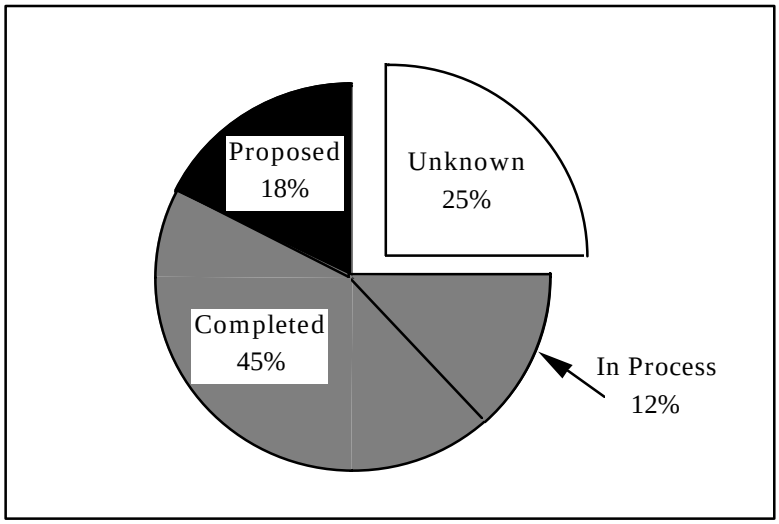

Figure 9-6. Example pie chart.

Each segment in a pie chart is coded using different colors, shadings, or textures and identified by a text label (presented in normal orientation) within the area. If the segment is too small to contain the label, it is placed outside the segment, with a line from it to the segment. The label describes the content of the segment and includes the number (i.e., percentage or actual value) being represented by the segment. Segments are emphasized by using special shading and by displacing them slightly from the remainder of the pie chart.

9.3 TACTICAL INFORMATION

9.3.1 Tactical Symbology

Tactical symbology and graphics conform with available military standards. MIL-STD 2525 defines a common warfighting symbology for command and control systems fielded by the military services.[4] The DoD style guide recommends that map graphic symbols conform with published standards such as NATO Standardization Agreement 2019 Military Symbols for Land-Based Systems, Army Field Manual 101-5-1 Operational Terms and Symbols, and the DIA Standard Military Graphics Symbols Manual. Applications with specific operational domain requirements are to comply with all relevant national and international symbology standards (e.g., Electronic Chart Display and Information Display System requirements for navigation systems published by the International Hydrographic Organization). If the application creates new symbology, it does so in ways that are consistent with applicable standards (e.g., pointed shapes are “hostile,” round or curved shapes are “friendly”) and match user expectations.

9.3.2 Coding of Tactical Information

[4] Implementation of the symbology is recommended in version 1 of the document but will be mandatory when version 2 is published in 1996.

If color is used to impart tactical meaning, it is used as a redundant code with another display feature (e.g., size, shape, text) and is not as the sole basis for coding. When color coding is used, each color represents one category of tactical data. If the application uses color to indicate threat status, it does so in accordance with applicable military standards. If the application uses color to indicate system status, it adheres to the following conventions:

Green / Blue = Operational / Normal / Noncritical
Yellow = Caution / Questionable
Red = Inoperative / Error

The background color behind text is not changed to show a change in system status because changing the background color usually reduces the readability of the text. Instead, the change is signaled by changing the color of an object (e.g, a box or circle) next to the text. The colors selected to convey tactical meaning are the same throughout the application, and their use is restricted to that function only. If one of these colors is assigned another meaning, a different shade is selected so as to minimize the likelihood of confusion with the convention.

Color can also be applied to tactical information for the purpose of alerting. In this case, only the information to which the application wants to direct user attention is assigned a unique color. As in color coding, a standard meaning in terms of alert criticality is assigned to each color, and that color is used only to convey this meaning. While alerting is usually indicated by assigning color to text information (e.g., in a list or table), colored icons can also be defined and appended to the information. Examples of how color might be applied as an alert indicator are provided below:

Vulnerability Time
Red = Vulnerable now
Yellow = Vulnerable in X minutes
Green = Vulnerable in Y minutes (where Y is greater than X)
Blue = Not vulnerable

Probability of Detection
Red = High probability (greater than X percent)
Yellow = Medium probability (less than X percent but greater than Y percent)
Green = Low probability (less than Y percent)

Confidence Factor
Red = Unknown
Yellow = Low
Green = High

Priority
Red = High
Yellow = Medium
Green = Low

Probability of Hostile Action
Red = Imminent
Yellow = Probable
Green = Possible
Blue = None

Action Items
Red = Now
Yellow = In X minutes
Green = No time limit
Blue = No action required

9.4 INFORMATION CODING

9.4.1 Color

Color is used redundantly and only to provide required functionality; coding methods other than color are applied whenever possible. The addition of color can increase response time and the likelihood of error due to color confusions. Color is a more effective code for search tasks and symbol identification tasks than other cues such as shape, size, or brightness. The performance advantage of color coding increases with the density of the symbols in a display and when the number of nontarget symbols of a different color than the target increases. However, color used excessively or inappropriately in displays can degrade user performance when compared to monochromatic displays.

The number of colors used to code the information in an alphanumeric display does not exceed seven, and only four codes are displayed at any one time. The number of colors used to code information on graphical displays does not exceed eight or nine, since users have difficulty discriminating among more than this number of colors. When information in a display is color coded, users have the option of displaying the meaning of the code as a reminder (e.g., in the message bar). Slight shade changes in color are not used to show gradation or choice. Shade differences are usually difficult to see, especially on a varied background such as a map. While normally discouraged as a graphical area discrimination technique, color shading, if used, is of sufficiently differing intensity as to be obvious and is not used to determine object selection or for control of the application.

Mayhew in Principles and Guidelines in Software User Interface Design provides the following ISO guidelines regarding color coding:

To denote:	Use:
Larger size	Saturated or bright colors
Smaller size	Desaturated or dark colors
Equal size	Colors equal in brightness
Heaviness	Saturated, dark colors
Lightness	Desaturated, light colors
Depth	Saturated, dark colors
Closeness	Saturated, bright colors
Height	Desaturated, light colors
Low-end continuum	Short-wavelength dark colors
High-end continuum	Long-wavelength bright colors

The DoD style guide provides the following additional guidelines on using color in computer display systems:[5]

a. Highly saturated colors, opposing colors (e.g., yellow and blue), and colors at spectral extremes (e.g., yellow and purple) are not used together because they may cause afterimages, shadows, and depth effects.

b. Pure white text is not displayed on a pure black background because this combination produces halation which makes the text less readable. Saturated blue is used only for background features in a display and not for critical data or for small lines or dots when the background is dark.

c. Both brightness and type of lighting (e.g., incandescent vs. fluorescent) can affect how colors are perceived. For example, bright ambient light desaturates display colors, leading to degraded color identification and discrimination.

d. At normal viewing distance from a screen, maximal color sensitivity is not reached until the size of a colored area exceeds about a three-inch square. Smaller size images become desaturated and change slightly in color. Also, small differences in actual color may not be discernible, and small adjacent colored images may be perceived to merge or mix.

e. Color discrimination is better when color images are displayed on an achromatic background (black, gray, or white) and achromatic images are displayed on a color background. If color

[5] More detailed guidelines on color use can be found in the DoD style guide.

images are displayed on color backgrounds, then background and symbol colors should contrast in both brightness and hue to ensure legibility.

9.4.2 Flashing

Flash coding is used only to display urgent information for user attention. No more than two levels of coding are used. The flash rate is in the range of 3-5 Hz with equal on/off intervals; if two levels of flashing are used, the second flashes at 1-2 Hz, with equal on/of times. When flash coding is applied to a displayed item, a flashing symbol (such as asterisks) is used rather than flashing the text itself. Users are able to acknowledge the event causing the flashing and suppress it if desired.

Windows Only: The application can flash the title bar of a window to draw attention to its contents. The flashing is accompanied by an auditory signal (e.g., one or two beeps) as a redundant cue in the event the flashing is not visible (e.g., the window is obscured).

9.4.3 Reverse Video

Reverse video is not used for coding since it is used in Motif and Windows for highlighting (e.g., to indicate that an object has been selected). Also, although effective in making data stand out, reverse video can reduce legibility and increase eye fatigue.

9.4.4 Size and Shape

If size coding is used, the number of size codes is limited to five or less, and users are required to interpret relative size rather than absolute size. Care should be taken when using size and color coding together since users' perception of object size can be manipulated by varying the color saturation and lightness of the object.

If shape coding is used, the number of shape codes is limited to 10-20, and the shapes used relate to the object or operation being represented. The color and detail added to the shapes are the minimum needed for users to identify the meaning assigned to the shape.

9.4.5 Sound

Auditory signals are used to alert users to critical conditions or operations. If auditory signals are associated with noncritical operations (e.g., as an alternate means of information presentation), they are used sparingly and users can acknowledge and turn off the signal at their discretion. Auditory signals are intermittent in nature and allow sufficient time to respond; they are distinctive in intensity and pitch, and the number of signals provided to users does not exceed four. The intensity, duration, and source location of the signal are selected to be compatible with the acoustic environment of users and the requirements of other personnel in the area surrounding the system.

9.4.6 Text Font and Style

If text font and/or style is used for coding, no more than two styles of type (e.g. regular and italics) or two weights (e.g., regular and bold) are available at one time. In addition, variations in type size are limited to no more than three at any one time. Capitalization can be used for emphasis in text but is not the sole indication of critical information in a window. While underlining is also effective in drawing user attention to specific text information, it can reduce legibility and so is used sparingly in the application. In addition, in hypermedia software, the underlining of a word or phrase is used to indicate the presence of a link to other information. If underlining is used in the application, it is implemented in ways that do not conflict with this convention.

9.5 DYNAMIC INFORMATION

Users can control the rate at which dynamically changing information is updated. In addition, they can freeze the display of any information that is being updated automatically and resume the updating either at the point of stoppage or at the current point in time. When users have to read dynamically changing information reliably and accurately, the update rate is no more than once per second. When users have to identify the rate of change or read gross values, the update rate is 2-5 times per second. Users are prompted to return to automatic updating after freezing a dynamic window (e.g., while users execute a print command) and are informed if significant changes in data occurred while the display was frozen.

Similar capabilities are available to users when interacting with auditory information. Users can control the playback of auditory information (e.g., start, stop, pause) as well as adjust the volume of the playback.